UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/657,337	09/08/2003	Syunji Hasuo	F - 7951	1660

28107 7590 01/27/2005

JORDAN AND HAMBURG LLP
122 EAST 42ND STREET
SUITE 4000
NEW YORK, NY 10168

EXAMINER	
MCNEIL, JENNIFER C	
ART UNIT	**PAPER NUMBER**
1775	

DATE MAILED: 01/27/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Offic Action Summary	Application No. 10/657,337	Applicant(s) HASUO ET AL.	
	Examiner Jennifer C McNeil	Art Unit 1775	

-- The MAILING DATE of this communication appears on the cov r sheet with th correspondenc address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 15 November 2004.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-4 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) 4 is/are allowed.

6)☒ Claim(s) 1-3 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

Claims 1 and 2 are objected to because of the following informalities: Claims 1 and 2 contain the phrase "an anodized film-containing aluminum alloy". This language is awkward. Does applicant intend to claim an anodized film on an aluminum alloy, *or* an anodized film formed of an aluminum alloy? If the latter is the case, it is not clear how the anodized film would consist essentially of Al and Mg when it is an oxide film and would necessarily contain oxygen. Also, would the film be present only with the substrate? Appropriate correction is required.

Claim Rejections - 35 USC $ 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by Hasegawa et al (US 5,988,262). Hasegawa teaches a sputtering target comprising an aluminum alloy. The alloy comprises aluminum having a purity of at least 99.9 wt% and contains 0.1-3.0 wt% of an element such as Mg. Regarding the term "anodization adapted", this term is not considered to structurally limit the alloy. Upon exposure to air, the target material would form a 'native oxide' layer. An inherent film formed upon exposure to air is considered a film, and the term "anodized" is does not structurally define the film over that which would be formed by the prior art.

Claims 1 and 3 are rejected under 35 U.S.C. 102(b) as being anticipated by Hasuo et al (JP 10-088271). Hasuo teaches an aluminum alloy having 99.9 wt% purity Al, and 0.35-2.5 wt% Mg. The alloy is suitable used in plasma chambers and plasma treatment apparatus. While Hasuo teaches the addition of silicon, an example is given wherein the silicon is 0.08 wt%. Applicant states that the presence of silicon in the range of 0.2-1.0 wt% would form Mg_2Si. The example given has less than this amount, and is therefore considered to not materially affect the basic and novel characteristics of the alloy. The example referred to also contains 0.19 wt% Fe, but is not considered to materially affect the alloy.

Allowable Subject Matter

Claim 4 is allowed.

Response to Arguments

Applicant amended claims 1 and 2 with language reflecting an anodized film in addition to an aluminum alloy. This has been interpreted as an alloy having an anodized film. Regarding Hasegawa, applicant argues that there is no presence of an anodized film. As stated above, upon exposure to air the alloy substrate would inherently form an oxide layer. A teaching of the reaction of an aluminum alloy with air is given in US Patent 6,713,188 in col. 6, lines 20-27. It is considered to meet the limitation of a film. Regarding Hasuo, applicant argues that silicon is present in an amount of 0.2-1.0 wt% and alloys falling within this range would be materially effected. As stated above, Hasuo gives an example where silicon is 0.8 wt%, which is outside of the range which applicant states would materially affect the alloy. Furthermore, the presence of 0.19 wt% Fe is not considered to materially affect the alloy. Regarding Thach, applicant's arguments and amendments have overcome the rejection of the previous office action.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer C McNeil whose telephone number is 571-272-1540. The examiner can normally be reached on 9AM-6PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Deborah Jones can be reached on 571-272-1535. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

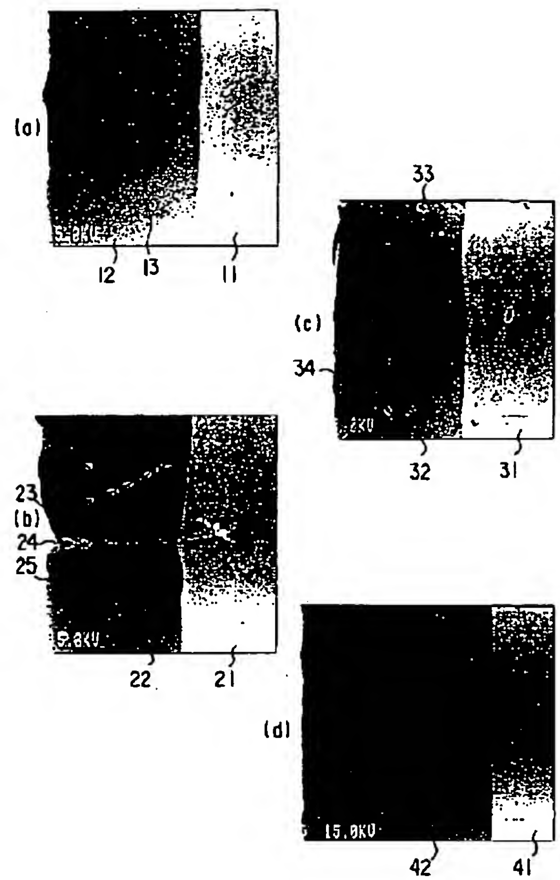
Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Jennifer McNeil
January 21, 2005

【図2】

	引張試験結果				伸び	硬度
	強　度		耐　力			
	kgf/mm^2	N/mm^2	kgf/mm^2	N/mm^2	%	Hμv
本アルミニウム合金	26.7	262	22.8	224	15	92.4
6061（T6）	31.6	310	28.0	275	12	108
5052（H32）	26.5	260	19.9	195	16	65
高純度アルミニウム	4.6	45	1.7	17	44	……

【図3】



【図4】

		5052 JIS 規格	6061 JIS 規格	5052 市販品	6061 市販品	高純度アルミニウム
		wt %	wt %	wt %	wt %	ppm
Si		0.25以下	0.40～0.80	0.08	0.72	18
Fe		0.40以下	0.70以下	0.19	0.26	8
Cu		指定無し	0.15～0.40	0.03	0.23	1
Mn		0.10以下	0.15以下	0.09	0.006	1
Mg		2.2～2.8	0.8～1.2	2.4	0.92	1
Cr		0.15～0.35	0.04～0.35	0.02	0.019	1
Zn		0.10以下	0.25以下	0.01	0.003	5
Ti		指定無し	0.15以下	0.03	0.018	1
Ni		指定無し	指定無し	0.006	0.005	1
B		指定無し	指定無し	0.001	0.002	1
V		指定無し	指定無し	0.013	0.013	1
その他	個々	0.05以下	0.05以下			
	計	0.15以下	0.15以下			

FIG. 2 is a schematic top view of a structure 200 which comprises an aluminum alloy (not shown) under an anodized coating layer 204 having defects 208.

FIG. 3A is a schematic of a photomicrograph which shows a cross-sectional view of an aluminum alloy 302 and anodized coating layer 304, structures which led to the defects 208 shown on the upper surface 209 of anodized coating 204 in FIG. 2.

FIG. 3B is a schematic of a photomicrograph which shows a cross-sectional view of an aluminum alloy 322 of the present invention, where no defects are observed on the upper surface 329 of anodized coating layer 324.

DETAILED DESCRIPTION OF THE INVENTION

As a preface to the detailed description, it should be noted that, as used in this specification and the appended claims, the singular forms "a", "an", and "the" include plural referents, unless the context clearly dictates otherwise.

The present invention is to provide a semiconductor processing apparatus which is resistant to corrosive processing conditions. FIG. 1 shows a schematic of a conventional reactor chamber 100 used for semiconductor substrate fabrication processes, such as chemical vapor deposition (CVD) or etching. Such processes typically subject the components within the chamber to corrosive halogen-containing species 118. Particularly corrosive are the gas mixtures typically used to plasma clean the chamber components, such as gas mixtures of carbon tetrafluoride with nitrous oxide (CF_4/N_2O) and tetrafluoroethylene with oxygen (C_2F_4/O_2), for example and not by way of limitation. During semiconductor processing chamber components are subjected to high temperatures ranging from 100° C. to about 450° C. and to corrosive halogen-containing gas mixtures during periodic chamber cleaning.

Referring to FIG. 1, certain chamber components, such as perforated plate 110 (which functions both to deliver process gases into the chamber and as an RF electrode for exciting a plasma) and susceptor 112 (which supports the semiconductor substrate 114 and also functions as an RF electrode) are conventionally constructed of aluminum with a surface protected by an anodized coating.

The most commonly used aluminum alloy in semiconductor processing equipment is 6061. To enable the aluminum alloy to resist corrosion, an anodized protective layer is applied over a surface of the aluminum alloy which is to be exposed to the corrosive processing environment. To obtain the best corrosion resistance and longest acceptable performance lifetime for the apparatus, the article is fabricated in a particular manner. For best results, the aluminum alloy used for the body of the article should be formed from a specialized clean aluminum alloy.

FIG. 2 shows a schematic top view of a semiconductor processing apparatus component 200 which was fabricated from a 6061 aluminum alloy (not shown) protected by an anodized coating 204. However defects 208 appeared on the surface 209 of anodized coating 204 after exposure of apparatus component 200 to a plasma etch environment. The defects 208 became sufficiently severe with time that contaminant particulates began to flake off in area 212 due to the presence of defects 208.

FIG. 3A shows a schematic of a cross-sectional view of a section 300 of a semiconductor processing chamber wall (not shown) where the chamber wall included a 6061 aluminum alloy 302 having a protective anodized layer 304 over the upper surface 305 of aluminum alloy 302, which forms an interface 307 between aluminum alloy 302 and anodized layer 304. Typically, this anodized layer 304 ranges in thickness from about 0.3 mil (8 μm) to about 4.0 mil (100 μm). We discovered that the cause of defects 311 on the upper surface 309 of the section 300 of the processing chamber wall was the formation of agglomerations 308 of impurities and impurity compounds which were present in the 6061 aluminum alloy. The agglomerations 308 formed conduits or channels 310 which extended through parts of the body 303 of the 6061 alloy and into the anodized coating 304, to produce defects 311 on the upper surface 309 of anodized coating 304. As a result, corrosive plasma species, for example, were able to penetrate through channels 310, downward through anodized coating 304 and were able to attack aluminum present at the interface 307 between anodized coating 304 and body 303. The mechanism illustrated in FIG. 3A explains the defects 208 which were observed on the upper surfaces of anodized 6061 aluminum process chambers, as illustrated in FIG. 2.

It is important to mention that for a "bare" 6061 alloy, which forms a native oxide about 30 Å to about 50 Å thick upon exposure to air, agglomerations of impurities at the upper surface of the aluminum alloy at the time of formation of the native oxide cause problems in the native oxide similar to and even more severe than those described with respect to anodized layers. The presence of such agglomerations can drastically degrade the protection which otherwise might be afforded by the native oxide.

Iron is a problem metal which may cause corrosion when present in an aluminum alloy used in semiconductor processing equipment. During manufacture of an aluminum alloy, large agglomerates of iron-containing compounds are frequently formed within the alloy. A large number of the agglomerations 308 shown in FIG. 3A include iron or iron-containing compounds, which are present at various locations within the aluminum alloy. The iron-containing agglomerates may appear in and on the surface of an alloy sheet, billet, or extruded part. For applications in industries other than the semiconductor industry, these agglomerates do not pose a problem. However, in the case of semiconductor processing equipment, the presence of iron-containing agglomerates in the starting material used to fabricate a processing vessel (or other apparatus internal to a processing chamber) can cause a major problem. Agglomerates 308 including the iron-containing compounds present at the interface 307 between body 303 and protective anodized coating 304 contribute to the formation of tunnels 310 through anodized coating 304 to the base aluminum in body 303. The tunnels 310 expose the base aluminum to various processing chemicals which can corrode aluminum alloy body 303. This is particularly true for applications of aluminum in semiconductor processing apparatus in which corrosive chlorine or fluorine-containing etchant gases and plasmas generated from these gases are employed. Eventually, if the corrosion is severe enough, entire areas of the apparatus surface can flake off into the semiconductor processing chamber and contaminate subsequent processing operations performed within the processing chamber. While the iron itself imparts no major beneficial quality to the alloy, the cost of removal of the iron from the alloy increases manufacturing cost of the alloy. As the iron content goes down, cost to manufacture the aluminum alloy goes up.

As described above, with respect to semiconductor processing apparatus, there are particular impurities, both in elemental and compound form which need to be controlled if the aluminum alloy is to be used for semiconductor processing applications. We have discovered that elements